AN AUTOMATED FISH MARKING AND TAGGING SYSTEM 9207300

SHORT DESCRIPTION:
Develop an automated mass-marking technique for juvenile salmonids that removes adipose fin and/or applies coded-wire tag without human handling or anesthetic. Design a unit that will process salmonids ranging from 60-150 mm without undue stress and at a rate of 2 fish/second or 50,000 fish in an 8 hour shift.

SPONSOR/CONTRACTOR: WDFW
Washington Department of Fish and Wildlife
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SUB-CONTRACTORS:
Northwest Marine Technology / Stratos

GOALS

GENERAL:
Maintains genetic integrity, Increases run sizes or populations, Adaptive management (research or M&E)

ANADROMOUS FISH:
Research, M&E

NPPC PROGRAM MEASURE:
8.4C.3

RELATION TO MEASURE:
Identify hatchery fish with a relatively inexpensive, benign, easily identifiable, and long lasting mark which can be applied at a high rate without individual human handling. Automated mass marking will allow measurement of hatchery straying and adverse effects (if any) by hatchery fish on wild populations. Provides option of selective fisheries.

BIOLOGICAL OPINION ID:
NMFS BO RPA

TARGET STOCK	LIFE STAGE	MGMT CODE (see below)
Chinook, basin-wide	Juvenile and adult	S.A.W.

AFFECTED STOCK	BENEFIT OR DETRIMENT
Coho, basin-wide	
Basin-wide Steelhead	Beneficial

BACKGROUND

Project is an office site only

HISTORY:
This project was initiated in 1992 to investigate the feasibility of using lasers to develop a viable mark and mass marking capability. The laser marks remained visible for only about one year. Project emphasis switched in 1994 to development of a machine that was capable of removing the adipose fin and/or injecting a coded wire tag. The laser investigations work funded by BPA totaled $500,000. BPA has funded an additional $1,700,000 for the mass marking machine development. An additional $800,000 has been cost shared by WDFW, Northwest Marine Technology and Stratos.

PROJECT REPORTS AND PAPERS:
Annual reports have been submitted to BPA and are available 2) Blankenship, H.L. and D.A. Thompson In press 1997 Development of a mass marking and tagging machine. American Fisheries Society. Annual Meeting, Monterey, California. 3) Blankenship, H.L. 1996 Mass marking and selective Fisheries: Recent history, current status, and Future. 47th Annual Northwest Fish Culture Conference, Victoria, B.C. Canada.

ADAPTIVE MANAGEMENT IMPLICATIONS:
The ability to mark all hatchery fish will allow studies to be performed on amount and effect of hatchery straying. An estimated savings of 33 percent for adipose clip/coded-wire tag over the present manual operation will allow funds to be re-prioritized to other projects. Without a machine like this it would not be physically possible to mark all of the Columbia River Basin hatchery chinook production. The use of lasers to permanently mark salmonids is now know to not be a reliable marking method.

PURPOSE AND METHODS

SPECIFIC MEASUREABLE OBJECTIVES:
Machine will adipose clip and/or coded-wire tag salmonids ranging in size from 60 mm to 150 mm at the rate of 2/second or 50,000/8 hour shift without use of anesthetic or individual handling by humans.

CRITICAL UNCERTAINTIES:
A new marking system is developed that would be less expensive to apply and/or is a more desirable mark from other perspectives.

BIOLOGICAL NEED:
The need to mark all juvenile hatchery salmon within the Columbia River Basin with a mark that is relatively inexpensive, readily conspicuous to laymen and scientists throughout the life of the fish without an appreciable increase in mortality has been identified and recommended by the Northwest Power Planning Council, ESA Recovery Plana, and state/federal/tribal fishery managers. Automated mass marking will allow measurement of hatchery straying and possible adverse effects of hatchery fish on wild fish populations. Mass marking hatchery fish provides the option of selective fisheries by harvesting hatchery stocks while protecting wild stocks.

HYPOTHESIS TO BE TESTED:
Juvenile salmonids exiting mass marking machine are missing adipose fin and contain a coded-wire tag in the cartilage area of the snout. Fish are not scaled or overly stressed by activities.

ALTERNATIVE APPROACHES:
The first approach was to develop laser marks. This promising marking technique did not meet expectations.

JUSTIFICATION FOR PLANNING:
NA This is a project to develop a more cost effective method of adipose marking and coded wire tag insertion.

METHODS:
This research and development project involves a multi-disciplinary team of biologists, engineers, and physicists collaborating to develop a mass marking machine. This has resulted in a successful prototype that works in a controlled environment. The next and final phase is to transform the working prototype into an operational piece of equipment that will work in a normal hatchery environment with variable sized fish.

PLANNED ACTIVITIES

SCHEDULE:

Planning Phase **Start** 10/92 **End** 10/94 **Subcontractor** yes

Task Investigate use of lasers for development of new marking method. Develop concept of automated machine capable of applying mass marks.

Implementation Phase **Start** 10/96 **End** 10/97 **Subcontractor** yes

Task Build and test prototype mass marking machine that works in a controlled environment.

O&M Phase **Start** 10/97 **End** 10/98 **Subcontractor** yes

Task Build and test mass marking machine that works in a hatchery environment.

PROJECT COMPLETION DATE:
9/98

CONSTRAINTS OR FACTORS THAT MAY CAUSE SCHEDULE OR BUDGET CHANGES:
None. This is the last funding segment. Private enterprise is expected to pick up any remaining developmental issues.

OUTCOMES, MONITORING AND EVALUATION

SUMMARY OF EXPECTED OUTCOMES

Expected performance of target population or quality change in land area affected:
A machine that can adipose clip and/or coded-wire tag salmonids ranging in size from 50-150mm without individual human handling or anesthetic without undue stress to the fish. The throughput is expected to be 2 fish/second or 50,000 fish in an 8 hour shift requiring two operators. Cost savings when compared to the present system of manually marking are expected to be 37 percent for adipose clipping and 33 percent for adipose/coded-wire tagging.

Present utilization and convservation potential of target population or area:
Currently, over 60 million salmonids are adipose marked and/or coded wire tagged yearly on the West Coast of the U.S. and Canada. Over 20 million of this amount is from the Columbia River Basin.

Assumed historic status of utilization and conservation potential:
NA

Long term expected utilization and conservation potential for target population or habitat:
Adipose mark and coded wire tag 20 million Columbia River Salmonids. Adipose mark an additional 120 million.

Contribution toward long-term goal:
Develop a more cost effective method of adipose marking and coded wire tagging large numbers of smolts in a manner that minimizes fish handling effects. Without an automated marking device, marking all hatchery salmonids in the Columbia River Basin is probably not achievable.

Indirect biological or environmental changes:
The mass marking machine will probably have the capability to also provide individual inoculation of salmonids with the same efficient handling procedures.

Physical products:
NA. This project only covers development of the mass marking machine, not the subsequent marking and tagging.

Environmental attributes affected by the project:
NA

Changes assumed or expected for affected environmental attributes:
NA

Measure of attribute changes:
NA

Assessment of effects on project outcomes of critical uncertainty:
Assessment of success will be based on level of usage and cost savings realized compared to costs for manual operations.

Information products:
NA

Coordination outcomes:
NA

MONITORING APPROACH
The need to mark all juvenile hatchery salmon within the Columbia River Basin with a mark that is relatively inexpensive, readily conspicuous to laymen and scientists throughout the life of the fish without an appreciable increase in mortality has been identified and recommended by the Northwest Power Planning Council, ESA Recovery Plan, and state/federal/tribal fishery managers. Automated mass marking will allow measurement of hatchery straying and possible adverse effects of hatchery fish on wild fish populations.

Provisions to monitor population status or habitat quality:
Identification of entire hatchery releases to monitor straying presently occurs only with a small percentage of hatchery releases.

Data analysis and evaluation:
The cost comparison and quality of marking and tagging will be compared to the traditional method which is done manually and is labor intensive.

Information feed back to management decisions:
Scientific and technical reports along with verbal presentations.

Critical uncertainties affecting project's outcomes:
Only development of mass marking machine will provide final resolution unless a new marking technique is developed in the future.

EVALUATION
Cost savings realized from automated marking and tagging. Ability to mass mark / tag larger numbers of fish due to automation.

Incorporating new information regarding uncertainties:
New marking systems would be tested against established systems in regards to desirable attributes.

Increasing public awareness of F&W activities:
If successful this automated mass marking / tagging marchine will definitely catch the eye of the public and scientific community. It has already created a high level of enthusiasm and awe in its ability to automate fin clipping and coded wire tag insertion.

RELATIONSHIPS

RELATED BPA PROJECT	RELATIONSHIP
	None

RELATED NON-BPA PROJECT	RELATIONSHIP
Laser Marking Salmonids / Oregon Sea Grant	Parallel work with funding cost shared
Mass-marking/ Washington Dept. Fish and Wildlife	Parallel work with funding cost shared

OPPORTUNITIES FOR COOPERATION:
Interest in this project has been expressed by NMFS, USFWS, ODFW, and California Dept. Fish and Game. These agencies recognize the need and have provided verbal and written support. Potential funding cooperation has also been expressed.

COSTS AND FTE

1997 Planned: $0

1997 Planned: $199,956

FUTURE FUNDING NEEDS:

FY	$ NEED	% PLAN	% IMPLEMENT	% O AND M
1998	$450,000		100%	
1999	$0			
2000	$0			
2001	$0			
2002	$0			

PAST OBLIGATIONS (incl. 1997 if done):

FY	OBLIGATED
1992	$248,845
1993	$320,326
1994	$160,000
1995	$949,747
1996	$414,324
1997	$199,956

TOTAL: $2,293,198

Note: Data are past obligations, or amounts committed by year, not amounts billed. Does not include data for related projects.

FY	OTHER FUNDING SOURCE	AMOUNT	IN-KIND VALUE
1998	WDFW	$90,000	

OTHER NON-FINANCIAL SUPPORTERS:
Substantial financial investment is expected to be made by private sector to make mass marking machines widely available to public after 1998 development has occurred.

LONGER TERM COSTS: NA No further financial support will be made after 1998 fiscal year.

1997 OVERHEAD PERCENT: Washington Department of Fish and Wildlife is waiving overhead charges for this project.

HOW DOES PERCENTAGE APPLY TO DIRECT COSTS:
NA

SUBCONTRACTOR FTE: 3 FTE